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Material Specifications

ALUMINUM CORRUGATED PIPE (SD-51)

MATERIAL SPECIFICATION

1. Scope

This specification covers the quality of aluminum corrugated pipe and fittings.

2. Pipe

Aluminum corrugated pipe and fittings shall meet ASTM B745, B746, or B790 and conform to the following additional requirements:

When close riveted pipe is specified, the pipe shall be fabricated with circumferential seam rivet spacing that does not exceed 3 inches except that 12 rivets are sufficient to secure circumferential seams in 12-inch pipe. Longitudinal seams that will be within the coverage area of a coupling band shall be connected by flat head rivets or welding.

3. Coatings

Bituminous coatings, when specified, shall conform to the requirements of ASTM A849.

4. Coupling Bands

Coupling bands must be provided to connect the pipe sections. The completed pipe joint shall be watertight and have tensile strength equal to the pipe sections. Gaskets must fit without warping, twisting, or bending.

5. Fittings

Fittings shall be aluminum meeting ASTM B744 and shall be coated the same as adjacent pipe.

Welded areas and areas that will have contact with dissimilar metals shall be cleaned to bright metal and promptly painted with two coats of a chromate rich primer.

COATED CORRUGATED STEEL PIPE (SD-50)

MATERIAL SPECIFICATION

1. Scope

This specification covers the quality of zinc-coated, aluminum-coated, aluminum-zinc alloy-coated, and polymer-coated corrugated steel pipe and fittings.

2. Pipe

All pipe shall be metallic zinc-coated, aluminum-coated, or aluminum-zinc alloy-coated corrugated steel pipe and fittings conforming to the requirements of ASTM A742, A760, A761, A762, A849, A875, A885, and A929 for the specified type, class, fabrication of pipe and coating, and to the following additional requirements.

When close riveted pipe is specified, the pipe shall be fabricated with circumferential seam rivet spacing that does not exceed 3 inches except that 12 rivets are sufficient to secure circumferential seams in 12-inch pipe. Longitudinal seams that will be within the coverage area of a coupling band shall be connected by flat head rivets or welding.

Where double riveting or double spot welding for pipe less than 42 inches in diameter is required, riveting or welding procedures shall be as specified for pipe 42 inches or greater in diameter.

3. Coatings

Coatings described herein equally refer to the inside and outside pipe surfaces. When coatings in addition to metallic coatings are specified, they shall conform to the requirements of ASTM A742, A760, A761, A762, A849, A875, A885, and A929 for the specified type.

Polymer-coated pipe shall be coated on each side to a minimum thickness of 0.01 inches (10 mils) (ASTM A762 grade 10/10).

4. Coupling Bands

Coupling bands must be provided to connect the pipe sections. The completed pipe joint shall be watertight and have tensile strength equal to the pipe sections. Gaskets must fit without warping, twisting, or bending.

5. Fittings

Fittings shall be steel and coated the same as adjacent pipe.

Welded (and adjacent) surfaces shall be cleaned of flux and weld splatter, and coated following ASTM A780.

CONCRETE PIPE AND TILE (SD-53)

MATERIAL SPECIFICATION

1. Scope

This specification covers the quality of concrete pipe and concrete drain tile as specified on the drawings.

2. Reinforced Concrete Pressure Pipe

Concrete pressure pipe shall meet the following requirements for the specified pipe. The actual pipe and fittings shall be designed by the manufacturer to provide the specified joint length, and limiting angle, and withstand the specified external loads and internal pressures.

Reinforced Concrete Pressure Pipe - Not Pre-stressed (except section 1.5 and 1.6) AWWA C300
Pre-stressed Concrete Pressure Pipe - Steel Cylinder Type (except sec 1.5 and 1.6) AWWA C301
Reinforced Concrete Pressure Pipe - Non-cylinder Type (except sec 4.2 & 4.3) AWWA C302
Concrete Pressure Pipe, Bar-wrapped, Steel Cylinder Type (except sec 4.2 & 4.3) AWWA C303
Low Head Pressure Pipe ..... ASTM C361

3. Concrete Culvert Pipe

Concrete culvert pipe shall meet the following requirements for the type and class of pipe specified.

Nonreinforced concrete culvert pipe ASTM C76 or C655
Round reinforced concrete culvert pipe ASTM C76 or C655
Reinforced concrete arch culvert pipe ASTM C506
Reinforced concrete elliptical culvert pipe ASTM C506
Reinforced box sections ASTM C789 or C850
Where rubber gasket joints are specified the joints shall meet ASTM C443.

4. Nonreinforced Concrete Pipe

Nonreinforced concrete pipe shall meet the following requirements for the type and class of pipe specified.

Standard concrete irrigation pipe (no rubber gasket joints) ASTM C118
Nonreinforced concrete irrigation pipe with rubber gaskets ASTM C505
Nonreinforced concrete drainage pipe ASTM C118
Perforated nonreinforced concrete ASTM C444
Concrete drain tile ASTM C412

5. Joint Sealing Compound

Joint sealing compound shall meet the following requirements for the type specified. Sealing compounds used with other joint material such as fillers or gaskets must be compatible.

Joints for concrete pipe, manholes, box sections using preformed flexible joint sealants ASTM C990
External sealing bands for noncircular concrete sewer, storm drain, and culvert pipe ASTM C877
Concrete joint sealer, hot poured elastic type ASTM D1190

6. Preformed Expansion Joint Filler

Preformed expansion joint filler shall conform to the following standards as specified on the drawings.

Preformed sponge rubber and cork expansion joint fillers for concrete paving and str. ... ASTM D1752
Preformed bituminous joint filler ..... ASTM D994 or D1751

CORRUGATED POLYETHYLENE (PE) PIPE (SD-55A)

MATERIAL SPECIFICATION

1. Scope

This specification covers the quality of corrugated polyethylene (PE) tubing and fittings.

2. Pipe and Tubing

Corrugated polyethylene tubing shall conform to the following requirements for the specified tubing types, sizes, and fittings.

ASTM F667	Standard Specification for Corrugated Polyethylene (PE) Tubing and Fittings
ASTM F667	Standard Specification for Corrugated Polyethylene Pipe and Fittings
ASTM F894	Standard Specification for Polyethylene (PE) Large Diameter Profile Wall Sewer and Drain Pipe
AASHTO M252	Standard Specification for Polyethylene Corrugated Drainage Pipe
AASHTO M294	Standard Specification for Corrugated Polyethylene Pipe, 12" to 36" diameter

GEOTEXTILE (SD-592)
MATERIAL SPECIFICATION

1. Scope

This specification covers the quality of geotextile.

2. General Requirements

Geotextiles shall be a minimum of 85 percent by weight polypropylenes, polyesters, polyamides, polyethylene, polyolefins, or polyvinylidenechlorides. They shall be formed into a stable network of filaments or yarns retaining dimensional stability relative to each other. The geotextile shall be defect free and conform to Table 1 or 2 requirements as applicable to the material specified. The geotextile shall be free of chemical treatments or coatings that reduce its porosity. Geotextiles shall have enhanced resistance to ultraviolet light.

Thread used for sewing shall be high strength polypropylene, polyester, or polyamide, and shall be at least as resistant to ultraviolet light as the geotextile.

3. Classification

Woven - Fabrics formed by interweaving monofilament yarn, creating distinct and measurable openings. The edges of woven fabric shall be selvedged or otherwise finished to prevent the outer yarn from unraveling.

Nonwoven - Fabrics formed by random placement of threads in a mat and bonded by needle punching.

4. Shipping and Storage

Geotextile shall be shipped in rolls wrapped with a cover. Each roll shall be labeled to clearly identify the brand, class, and production run following ASTM D4873.

Table 1. Requirements for Woven Geotextile

Property	Test Method	Class I	Class II&III	Class IV
Tensile strength, lb.[1/]	ASTM D4632	200 min.	120 min.	180 min.
Elongation at failure, %[1/]	ASTM D4632	< 50	< 50	< 50
Puncture, lb.[1/]	ASTM D4833	90 min.	60 min.	60 min.
Ultraviolet light, %residual tensile strength	ASTM D4355 150-hr. exposure	70 min.	70 min.	70 min.
Apparent Opening size (AOS)	ASTM D4751	As specified, but > .212mm (#70[2/])	As specified, but > .212 mm (#70)	As specified, but >.212mm (#70)
Percent open area (%)	CWO-02215-86[3/]	4.0 min.	4.0 min	1.0 min.
Permeability, permittivity $Sec.^{-1}$	ASTM D4491	0.10 min.	0.10 min.	0.10 min.

Table 2. Requirements for Needle-Punched Nonwoven Geotextile

Property	Test Method	Class I	Class II	Class III	Class IV
Tensile Strength, lb.[1/]	ASTM D4632	180 min.	120 min.	90 min.	115 min.
Elongation at failure, %[1/]	ASTM D4632	$\geq$ 50	$\geq$ 50	$\geq$ 50	$\geq$ 50
Puncture, lb.	ASTM D4833	80 min.	60 min.	40 min.	40 min.
Ultraviolet light, % residual tensile strength	ASTM D4355 150-hr. exposure	70 min.	70 min.	70 min.	70 min.
Apparent Opening Size (AOS)	ASTM D4751	As specified max. #40[2/]	As specified max. #40[2/]	As specified max. #40[2/]	As specified max. #40[2/]
Permeability permittivity sec^{-1}	ASTM D4491	0.70 min.	0.70 min.	0.70 min.	0.70 min.

1/ Minimum average roll value (weakest principal direction).
2/ US standard sieve size.
3/ CWO is a US Army Corps of Engineers reference.

PLASTIC PIPE (SD-55)

MATERIAL SPECIFICATION

1. Scope

This specification covers the quality of Poly Vinyl Chloride (PVC), Polyethylene (PE), High Density Polyethylene (HDPE), and Acrylonitrile-Butadiene-Styrene (ABS) plastic pipe, fittings, and joint materials.

2. Material

The pipe and fittings shall be free of visible cracks, holes, foreign inclusions, or other defects, and shall have dimensions measured as prescribed in ASTM D2122. Joints and fittings shall be as described in the pipe AWWA or ASTM specification and shall be compatible with and have pressure ratings at least equal to the specified pipe. Rubber gaskets for pipe joints shall conform to ASTM F477 Elastomeric Seals (Gaskets for Joining Plastic Pipe). Except as otherwise specified, pipe must conform to the following specifications.

Poly vinyl chloride (PVC) Pipe

Plastic pipe - Schedule 40, 80, or 120	ASTM D1785 or D2466
Pressure rated pipe - SDR Series	AWWA C900 or ASTM D2241
Plastic drain, waste, and vent pipe and fittings	ASTM D2665
Composite sewer pipe	ASTM D2680
Type PSM PVC sewer pipe and fittings	ASTM F3034
Large-diameter gravity sewer pipe and fittings	ASTM F679
Smooth-wall Underdrain Systems for Highway, Airport, and Similar Drainage	ASTM F758
Type PS-46 gravity flow sewer pipe and fittings	ASTM F789
Profile gravity sewer pipe and fittings based on controlled inside diameter	ASTM F794
Corrugated sewer pipe with a smooth interior and fittings	ASTM F949
Pressure pipe, 4-inch through 12-inch for water distribution	AWWA C900
Water transmission pipe, nominal diameters 14-inch through 36-inch	AWWA C905

Polyethylene (PE) pipe

Schedule 40	ASTM D2104
SIDR-PR based on controlled inside diameter	ASTM D2239
Schedules 40 and 80 based on outside diameter	ASTM D2447
SDR-PR based on controlled outside diameter	ASTM D3035

High density polyethylene (HDPE) pipe

Plastic pipe and fittings	ASTM D3350
SDR-PR based on controlled outside diameter	ASTM F714
Plastic moldings and extrusion compounds	ASTM D1248
Heat joining polyolefin pipe and fittings	ASTM D2657

Acrylonitrile-butadine-styrene (ABS) pipe

Plastic pipe, schedules 40 and 80	ASTM D1527
Plastic pipe, SDR-PR	ASTM D2282
Schedule 40 plastic drain, waste, and vent pipe	ASTM D2661
Composite sewer pipe	ASTM D2680
Sewer pipe and fittings	ASTM 2751

3. Perforations

Except as otherwise specified, perforations of perforated pipe shall meet the following requirements.

a. Perforations may be circular or slots, but must be free of materials that reduce effective openings.

b. Circular perforations shall be 3/16 to 5/16 inch diameter holes arranged in rows parallel to the axis of the pipe. Center-to-center perforation spacing along rows shall not exceed 2.5 inches. Perforations may appear at the ends of short and random lengths.
Rows shall be arranged in equal groups at equal distance from pipe bottom vertical centerline. Lowermost rows shall be separated by 60 to 125 degrees. Uppermost rows shall be separated by an arc of 166 degrees or less. Other rows shall be uniformly spaced.

c. Slot perforations shall be located within two rows, with one row in each of the lower quadrants of the pipe. Slots shall be no wider than 1/8 inch and spaced no more than 1.5 inches apart.

d. Row numbers and minimum openings must be as follows.

Perforations			
Nominal pipe size, inch	**Minimum number of rows**		**Minimum opening/foot, square inches**
	circular	**slot**	
3 to 4	2	2	0.22
6 to 10	4	2	0.44
12 or larger	6	2	0.66

4. Potable use pipeline

Pipelines specified for use to carry potable water shall meet requirements of the National Sanitation Foundation (NSF).

STEEL PIPE AND FITTINGS (SD-52)

MATERIAL SPECIFICATION

1. Scope

This specification covers the quality of steel pipe and fittings.

2. Pipe

Steel pipe shall conform to the requirements of the applicable specification listed below for the kind of pipe and the weight, grade, and finish or coating specified.

Steel, black and hot-dipped, zinc coated welded and seamless	ASTM A53
Steel, electric-fusion (ARC) welded steel (sizes NPS 16 and over)	ASTM A134
Electric-resistance-welded steel	ASTM A135
Electric-fusion (ARC)-welded steel (NPS 4 and over)	ASTM A139
Steel water pipe, 6 inches and larger	AWWA C200

3 Welding Electrodes

Welding electrodes shall conform to American Welding Society Specification	AWS A5.1

4. Fittings

Fittings shall conform to the requirements for the types and kinds specified.

Heat-treated carbon steel fittings for low-temperature and corrosive service	ASTM A858
Threaded couplings, steel, black or zinc-coated (galvanized) welded or seamless	ASTM A865

5. Coating and Lining

Except as otherwise specified, coatings and linings shall conform to the following standards as specified or as appropriate.

Galvanized coatings	ASTM A53
Coal-tar protective coatings and linings - Enamel and Tape - hot-applied	AWWA C203
Cold-applied tape coatings for exterior of special sections, connections, and fittings	AWWA C209
Tape coating systems for exterior of steel water pipelines	AWWA C214